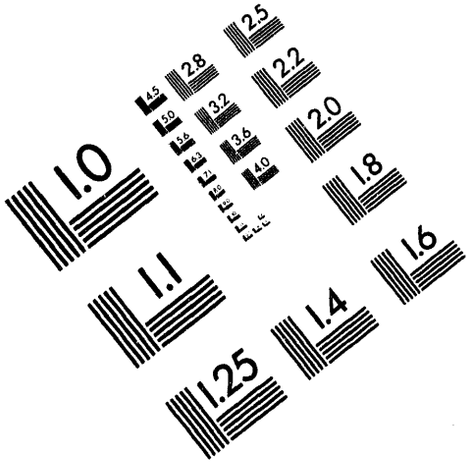

Association for Information and Image Management
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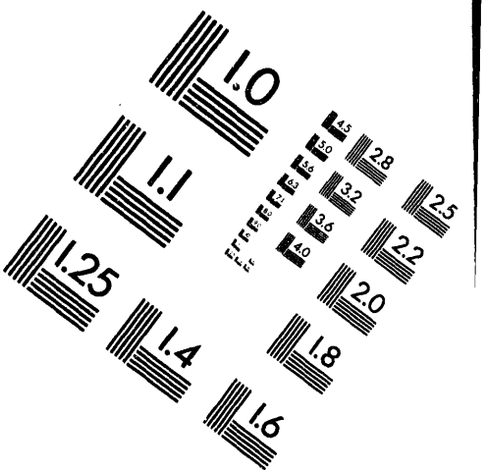
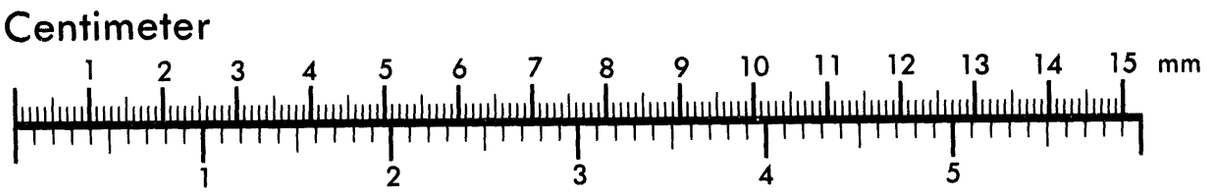
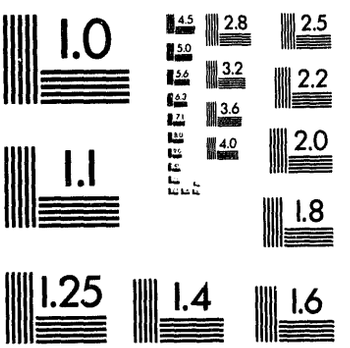
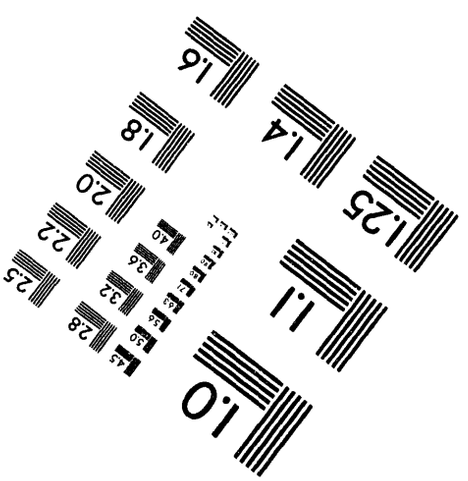
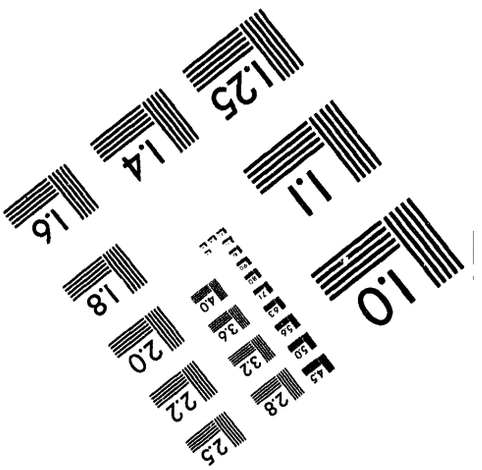
Silver Spring, Maryland 20910
301/587-8202











1 of 1

Draft

DOE/MT/92009--8

EVALUATION OF THE FREEZE-THAW/EVAPORATION PROCESS FOR THE TREATMENT OF PRODUCED WATERS

QUARTERLY TECHNICAL PROGRESS REPORT

Contract No. DE-AC22-92MT92009

Prepared by:

Resource Technology Corporation
P.O. Box 1346
2931 Soldier Springs Road
Laramie, WY 82070

Report Date: July 1994
Contract Date: August 6, 1992
Contract Completion Date: July 31, 1995
US Department of Energy FY 94 Award: $81,943

Project Manager: John Boysen (307) 742-5452
Principle Investigators: John Boysen and Joseph Morotti

Contracting Officer's Representative: Gene Pauling (504) 734-4131
United States Department of Energy
Metairie Site Office
900 Commerce Road East
New Orleans, LA 70123

Reporting Period: April 1 - June 30, 1994

TABLE OF CONTENTS

Executive Summary

The use of freeze-crystallization is being increasingly acknowledged as a low-cost, energy-efficient method for purifying contaminated water. Freeze-crystallization has been shown to be effective in removing a wide variety of contaminants from water. Water purification by using natural conditions to promote freezing appears to be an extremely attractive process for the treatment of contaminated water in many areas where natural climatic conditions will seasonally promote freezing. The natural freezing process can be coupled with natural evaporative processes to treat oil and gas produced waters year round in regions where subfreezing temperatures seasonally occur. The objectives of this research are related to development of a commercially-economic natural freeze-thaw/evaporation (FTE) process for the treatment and purification of water produced in conjunction with oil and gas.

During the reporting period of 4/1/94 to 6/30/94, project research concentrated on Subtasks 2.0 (Task 2 Project Reporting) and 2.1 (Laboratory-scale FTE Simulations). The objectives of Task 2 are to conduct laboratory- and bench-scale simulations for optimizing the design of the FTE process. Task 2 requires completion of six subtasks: Subtask 2.0 - Task 2 Project Reporting (initiated 3/1/93), Subtask 2.1 - Laboratory-scale FTE Simulations, Subtask 2.2 - Re-evaluation of Process Economics Based on Laboratory-scale Process Simulation Results, Subtask 2.3 - Bench-scale FTE Simulations, Subtask 2.4 - Economic Assessment of Bench-scale Simulations, and Subtask 2.5 - Technical Report of Task 2. The construction, shakedown, and operation of the laboratory-scale process simulations planned were planned for this quarter (Subtask 2.1).

Research efforts this quarter were:

- The construction and shakedown of the laboratory simulator were completed.
- The initial simulations were started in May and completed in June. The objective of the initial simulation series was to determine the best equipment design and operation.
- The second simulation series was initiated in June and is expected to be completed in July. In this series of simulations, each of the three waters selected are being tested under climatic conditions simulating the averages for northeastern Colorado.
- Samples of produced water from a natural gas producing well in Weld County, CO, an oil and gas producing well near Brighton, CO, and a coal bed methane well in the San Juan Basin were submitted in May and analyzed by Evergreen Laboratories for radionuclide and organic characterization. To summarize the results of the radionuclide analyses: none of the three produced waters contained detectable quantities of Uranium or Radium 228, detectable quantities of Gross Alpha radiation were found only in the FTE C (coal bed methane) produced water, detectable quantities of Radium 226 were found in the FTE A (oil and gas) and FTE B (natural gas) produced waters. All three produced waters contained detectable quantities of total strontium. In all cases, the quantity of radionuclides present in these waters are considered minor and non-hazardous by the analytical laboratory. Results of the volatile organic analyses indicate benzene, toluene, and xylene (BTEX) were present in the FTE A water and the FTE B water; and essentially no volatile organics (only 1 ug/l toluene) were found in the FTE C water.
- The three waters were submitted to the University of North Dakota Energy and Environmental Research Center for detailed inorganic characterization. Results of these analyses are expected in July.

Plans for the next quarter are to:

- finish the second series and conduct the third and forth series of laboratory simulations and analyze samples,
- begin modification of the economic evaluation software, and
- continue negotiations with interested parties in an attempt to conduct a commercial demonstration of the process next year.
- Finalize and print the "Task 1 Report" according to new GRI specifications. RETEC has agreed to take care of the printing.
- Present a paper at the "1994 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations" to be held July 11-13, at the Colorado School of Mines in Golden, CO.

1.0 Introduction

1.1 Background

The cost of treating the water produced in association with oil and natural gas has prevented the completion of wells in economically marginal formations and has caused low-productivity wells to be prematurely shut-in. An economical method for treatment, disposal, and/or reuse of these waters on a commercial-scale would assist the oil and natural gas industries in continuing to provide reasonably priced fuels to the consumer by allowing for economic production from marginal, unconventional, and depleted reserves. A treatment process that could produce water of suitable quality for reuse would also be advantageous for municipal, industrial, and agricultural development in the arid western United States where there is significant oil and natural gas production.

The natural processes of freezing and evaporation can be coupled to effectively and inexpensively treat waters produced in association with natural gas. This document delineates research conducted, during the time period from 4/1/94 to 6/30/94, for evaluating the technical and economic feasibility of this water treatment process. The research, required for development of this process, has three distinct tasks:

Task 1: Literature Survey and Preliminary Economic Analysis

Task 2: Laboratory- and Bench-Scale Process Evaluation

Task 3: Field Demonstration of the Process

The current contract (US DOE contract No. **DE-AC22-92MT92009**) is for completion of research to be conducted in Tasks 1 and 2 only. If successful, funding for Task 3 will then be solicited.

1.2 Research for the Current Reporting Period

Research conducted during this time period was related to Task 2. The objectives of Task 2 are to conduct laboratory- and bench-scale simulations for optimizing the design of the FTE process. Task 2 requires completion of six subtasks: Subtask 2.0 - Task 2 Project Reporting, Subtask 2.1 - Laboratory-scale FTE Simulations (initiated 3/1/93), Subtask 2.2 - Re-evaluation of Process Economics Based on Laboratory-scale Process Simulation Results, Subtask 2.3 - Bench-scale FTE Simulations, Subtask 2.4 - Economic Assessment of Bench-scale Simulations, and Subtask 2.5 - Technical Report of Task 2.

During the reporting period, work conducted was related to Subtasks 2.0, and 2.1. Subtask 2.0 research efforts this quarter were related to monthly project reporting. Subtask 2.1 efforts included: completion of the construction and shakedown of the laboratory simulator; completion of the initial simulations; initiation of the second simulation series in June with expected completion in July; analyses of samples of the three samples of produced water (a natural gas produced water from a well in Weld County, CO, an oil and gas produced water from a well near Brighton, CO, and a coal bed methane produced water from a well in the San Juan Basin) for radionuclide and organic characterization; and, submission of samples of the three waters to the University of North Dakota Energy and Environmental Research Center for detailed inorganic characterization.

2.0 Project Description

2.1 Project Research Tasks and Subtasks

Following is a brief description of the project tasks and subtasks. The research required to complete each task/subtask is also summarized:

2.1.1 Task 1: Literature Survey and Preliminary Economic Analyses

A literature survey and preliminary economic feasibility and sensitivity analyses will be conducted to evaluate the technical feasibility and commercial viability of the FTE process. Specific subtasks to be performed are:

Subtask 1.1 - Literature Survey of FTE Research: 1) identify economically important FTE process parameters, 2) summarize the response of organics, metals and salts in contaminated waters to the FTE process, and 3) estimate potential interactions between constituents that may impact the process.

Subtask 1.2 - Characterization of Natural Gas Production Waters and Conventional Treatment Costs: 1) review of literature and data bases to characterize typical waters that are generated in association with production from natural gas reservoirs, oil and gas reservoirs, and methane drainage from coal seams, 2) survey meteorological data to establish an expected range of atmospheric conditions at selected production sites where the FTE process is applicable (Survey will include daily wind velocity and temperature cycles), and 3) survey local producers to determine their current treatment/ disposal methods, costs, and willingness to participate in a field demonstration of the process.

Subtask 1.3 - Evaluation of Process and Environmental Constraints: 1) estimate FTE discharges and evaluate regulatory requirements for field and commercial-scale demonstration, 2) assess process discharges, regulatory requirements, and costs of conventional methods of disposal/treatment of production waters, and 3) compare of the environmental acceptability, regulatory requirements and costs of the FTE process to conventional methods.

Subtask 1.4 - Conceptual Process Design: 1) design a preliminary FTE process based on the results of work elements 1.1 through 1.3 to address environmental, regulatory and process issues for various types of produce waters.

Subtask 1.5 - Preliminary Economic Feasibility and Sensitivity Analyses: 1) develop a numerical discounted cash flow /rate of return economic model for the preliminary FTE process design resulting from Subtask 1.4; 2) evaluate the economics of a probable, base case operating scenario which assumes reasonable fixed values for: a) facility size and location, b) concentrations of salts, organics and heavy metals in the production water, c) atmospheric conditions, d) capital equipment costs, e) annual operating expenses, f) debt to equity ratio, g) bond interest, and h) return on investment after taxes; and 3) determine the economic sensitivity of the FTE process by evaluating the projected water treatment costs for a minimum of 33 differing operating scenarios.

Subtask 1.6 - Task 1 Summary Report: 1) provide a comprehensive analysis of the results of Tasks 1.1 through 1.5 and 2) determine if the FTE process is technically feasible, economically viable and economically stable.

2.1.2 Task 2: Laboratory- and Bench-Scale Process Simulation

Task 2 is the laboratory and bench-scale evaluation of the FTE process. The following subtasks are required for completion of Task 2:

Subtask 2.1 - Laboratory-scale Process Simulations: 1) design and construct a laboratory-scale simulator to test the FTE process; 2) conduct an initial series of nine process simulations to optimize the FTE process design by evaluating the effectiveness of the three different freezing design options: wetted column freezing, conventional water sprays, and atomizing sprays and three different evaporation techniques: conventional evaporation ponds, solar evaporation ponds, and solar distillation ponds; 3) conduct an additional series of eight process simulations, using the optimum process design for treating three different produced waters under three differing sets of atmospheric conditions, to determine the effectiveness of the FTE process in removing organic, metal, and

salt constituents from mixtures; 4) conduct a duplicate simulation for each of the produced waters tested to verify experimental results.

Subtask 2.2 - Re-evaluation of Process Economics Based Upon Laboratory-scale Simulation Results: 1) re-evaluate FTE process economics using the numerical model developed in Subtask 1.5 based upon Subtask 2.1 simulations results.

Subtask 2.3 - Bench-Scale FTE Simulations: 1) design and construct three bench-scale simulations to verify the process effectiveness under actual climatic conditions, 2) conduct the simulations for one year, 3) confirm laboratory-scale simulation results under atmospheric conditions in Laramie, WY, 4) demonstrate the effectiveness of the process, and 4) acquire data for process scale-up.

Subtask 2.4 - Re-evaluation of Process Economics Based Upon Bench-scale Simulation Results: 1) re-evaluate FTE process economics using the numerical model and the Subtask 2.3 simulation results, and 2) refine the process design, equipment selection, construction procedures, and plant operating procedures for field demonstration using an FTE process.

Subtask 2.5 - Final Technical Report of the Simulation Results, Revised Process Economics, and Final Demonstration Plant Design and Economic Requirements: 1) write a technical report summarizing the results of the FTE process simulations, providing a commercial-scale process economic projection and the finalized technical and economic requirements of an FTE process demonstration plant for the treatment of natural gas production waters. This report will also provide detailed requirements for completion of Task 3.

2.1.3 Task 3: Field Demonstration of the FTE Process

Task 3 will be a field demonstration of the FTE process conducted at an operating production site. Task 3 will be initiated if results of Task 2 show FTE to be a technically and economically viable process. The field demonstration will confirm the process's commercial viability. It will incorporate all technical innovations and process improvements resulting from previous research efforts. The details relating to the work required to complete Task 3 will be determined in the research conducted in Tasks 1 and 2 of the current contract.

2.2 Project Objectives

The general objective of the research is to develop and demonstrate a cost-effective economically viable commercial technology that utilizes the natural FTE process to treat water produced in conjunction with oil and natural gas. The specific objectives of the research are to:

- develop an economic model for determining the commercial viability, economically significant parameters, and research issues of the FTE process,
- conduct laboratory- and bench-scale process simulations to optimize the design of the FTE process, and
- to conduct on-location treatment of water from a producing well to demonstrate the technical and economic viability of the FTE process.

3.0 Project Status

3.1 Work Performed during the Reporting Period

3.1.1 Subtask 2.0 Task 2 Project Reporting

As of the end of the reporting period, project reports required for the months of April, May, and June 1994 were complete and submitted to the US DOE Document Control Center at PETC and to Remediation Technologies, Inc. No budget or schedule problems exist for this subtask.

3.1.2 Subtask 2.1 Laboratory-scale FTE Simulations

During the reporting period, Subtask 2.1 efforts included:

- Completion of the construction and shakedown of the laboratory simulator.

- Completion of the initial series of nine process simulations. The oil and gas produced water (FTE A) was used in the initial simulation series (nine simulations) because preliminary inspections of the water samples indicate that, of the three produced waters in-house (FTE A - oil and gas produced water, FTE B - gas produced water, and FTE C - coal bed methane produced water), it will be the most difficult water to treat. Preliminary indications are that the FTE process was significant in reducing total dissolved solids (TDS) content of the produced water to levels that would be acceptable for discharge (< 2,000). This observation is true for each of the nine simulations and is based entirely upon TDS meter readings. Results of laboratory sample analyses in progress will be required to confirm this observation. The TDS content of the brine produced, based again on meter readings, varied considerably among the nine simulations but in all cases was in the range of or considerably higher than the range considered in the economic analyses completed in Task 1 of this research. The high TDS concentrations of the brines produced is economically favorable. The treated water to brine yields also varied but in several of the equipment designs tested the yields were quite economically favorable. Somewhat unexpected was high evaporation rates achieved during months simulating winter conditions. Since the continued pumping and water circulation of the produced water holding ponds prevented their freezing, evaporation into the cold dry air was greater than anticipated. The objective of the initial simulation series was to determine the best equipment design and operation.

- Initiation of the second simulation series with expected completion in July. In this series of simulations, each of the three waters selected are being tested under climatic conditions simulating the averages for northeastern Colorado.

- Samples of each produced water were submitted in May and analyzed by Evergreen Laboratories for organic and radionuclide characterization. Detailed results of these analyses are provided in Appendix A. To summarize the results of the radionuclide analyses: none of the three produced waters contained detectable quantities of Uranium or Radium 228, detectable quantities of Gross Alpha radiation were found only in the FTE C (coal bed methane) produced water, detectable quantities of Radium 226 were found in the FTE A (oil and gas) and FTE B (natural gas) produced waters. All three produced waters contained detectable quantities of total strontium: 4.6, 7.6, and 11 mg/l in FTE A, B, and C, respectively. In all cases, the quantity of radionuclides present in these waters are considered minor and non-hazardous by the analytical laboratory. Results of the volatile organic analyses indicate: Benzene, Toluene, and Xylenes in the low ppm range (15 mg/l benzene, 9 mg/l toluene, and 2 mg/l xylene) and Carbon Disulfide (190 ug/l), 2-Butanone (1,400 ug/l), and Ethyl Benzene (180 ug/l) were present in the FTE A water only; benzene was present in the low ppm range (2 mg/l benzene) and toluene (870 ug/l) and xylene (470 ug/l) were present in the ppb range in the FTE B water; and essentially no volatile organics (only 1 ug/l toluene) were found in the FTE C water. Results of the Semivolatile organic analyses indicate: quantities of Naphthalene (39 ug/l), 2-Methylnaphthalene (29 ug/l), and Fluorene (49 ug/l) along with phenols (3,100 ug/l Phenol, 930 ug/l 2-Methylphenol, 650 ug/l 4-Methylphenol, and 200 ug/l 2, 4-Dimethylphenol) were present in the FTE A water; quantities of Naphthalene (6 ug/l), 2-Methylnaphthalene (33 ug/l), and Phenanthrene (6 ug/l) along with phenols (110 ug/l Phenol, 220 ug/l 2-Methylphenol, 10 ug/l 4-Methylphenol, and 150 ug/l 2, 4-Dimethylphenol) were present in the FTE

B water; and no semi-volatile organic compounds were present in the FTE C water. (Note: Phthalates found are not considered because their origin is generally accepted to be from the plastic materials used in the storage containers.)

- The three waters were submitted to the University of North Dakota Energy and Environmental Research Center for detailed inorganic characterization. Results of these analyses are expected in July.

The budget for this subtask and the schedule have been impacted by a number of events, but simulator operation is progressing now. No other subtasks were scheduled for this reporting period. However, negotiations are still in progress to find a participant in the commercial demonstration of the process.

3.2 Summary of Achievements

Project achievements for the time period of 4/1/94 to 6/30/94 are:

- completion of the construction and shakedown of the laboratory simulator;
- completion of the initial simulations;
- initiation of the second simulation series in June with expected completion in July;
- completion of analyses of samples of the three samples of produced water (a natural gas produced water from a well in Weld County, CO, an oil and gas produced water from a well near Brighton, CO, and a coal bed methane produced water from a well in the San Juan Basin) for radionuclide and organic characterization; and,
- submission of samples of the three waters to the University of North Dakota Energy and Environmental Research Center for detailed inorganic characterization.

4.0 Planned Activities for the Next Quarter

During the upcoming quarter (July 1 - September 30, 1994), plans are to:

- finish the second series and conduct the third and forth series of laboratory simulations and analyze samples,
- begin modification of the economic evaluation software, and
- continue negotiations with interested parties in an attempt to conduct a commercial demonstration of the process next year.
- Finalize and print the "Task 1 Report" according to new GRI specifications. RETEC has agreed to take care of the printing.
- Present a paper at the "1994 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations" to be held July 11-13, at the Colorado School of Mines in Golden, CO.

The requirements for and work planned for Subtasks 2.1 and 2.2 are:

4.1 Subtask 2.1 Laboratory-scale Freeze-Thaw/Evaporation Simulations

The objectives of Subtask 2.1 are to: 1) design and construct a laboratory-scale simulator and simulation procedure for the freeze-thaw evaporation process; 2) optimize the FTE process design by conducting process simulations to evaluate the effectiveness of three differing freeze-thaw design options, two differing

evaporation pond design options, and one solar distillation pond design option; 3) determine experimentally the impact of production water quality on the effectiveness of the FTE process; and 4) determine experimentally the impact of atmospheric conditions on the effectiveness of the FTE process. During the next quarter all efforts related to Subtask 2.1 will be directed towards the attainment of objectives 2 and 3.

4.2 Subtask 2.2 Re-evaluation of Process Economics Based Upon Laboratory-scale Simulation Results

The objective of Subtask 2.2 is to re-evaluate FTE process economics using the numerical model developed in Subtask 1.5 based upon Subtask 2.1 simulations results. As data are obtained from laboratory simulations, model modifications will be conducted during the next quarter

5.0 Summary

Task 1 is complete. Results of Task 1 research indicate the process has significant commercial economic potential and is an environmentally acceptable option to produced water disposal by deep well injection. Contacts have been and will continue to be made with oil and gas producers in the area. The objectives of these contacts are to obtain representative produced waters for testing and to discuss possible future involvement in the process demonstration. At the present time Thorofare Resources, Inc., Silverado Oil, and Southwest Water Disposal have expressed interest in demonstration of the process. Negotiations will continue with interested parties to construct a FTE facility for commercial demonstration of the process in 1994.

In Task 2, the construction and shakedown of the laboratory simulations are completed and the initial simulations were started in May and completed in June. The preliminary analyses of the initial simulation results tend to confirm the technical and economic feasibility of the FTE process. Indications are that the FTE process was significant in reducing total dissolved solids (TDS) content of the produced water to levels that would be acceptable for discharge (< 2,000). This observation is true for each of the nine simulations and is based entirely upon TDS meter readings. Results of laboratory sample analyses in progress will be required to confirm this observation. The TDS content of the brine produced, based again on meter readings, varied considerably among the nine simulations but in all cases was in the range of or considerably higher than the range considered in the economic analyses completed in Task 1 of this research. The high TDS concentrations of the brines produced is economically favorable. The treated water to brine yields also varied but in several of the equipment designs tested the yields were quite economically favorable. Somewhat unexpected was high evaporation rates achieved during months simulating winter conditions. Since the continued pumping and water circulation of the produced water holding ponds prevented their freezing, evaporation into the cold dry air was greater than anticipated.

The current project status is behind schedule but with no budget problems. The long-term impact of the schedule problem resulting from Subtask 2.1 efforts is not expected to delay contract completion at this time. Completion of Subtasks 2.1 and 2.2 will be delayed.

6.0 Report Distribution

The quarterly progress report distribution specified by the current contract is three copies of quarterly reports to:

Document Control Center
United States Department of Energy
Pittsburgh Energy Technology Center
P.O. Box 10940, MS 921-118
Pittsburgh, PA 15236 - 0940

7.0 References

None

8.0 Publications

Boysen, J.E., 1994, "Evaluation of the Freeze-thaw/Evaporation Process for the Treatment of oil and Gas Produced Waters", Proceedings: 1994 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations - Soft Footprints for the '90's, Colorado School of Mines/U.S. Bureau of Land Management, Golden, Colorado, July 11-13, 1994, pages 179-188, ISBN 0-918062-97-7.

Appendix A

RESULTS OF RADIONUCLIDE AND ORGANIC ANALYSES OF PRODUCED WATER SAMPLES FROM AN OIL AND GAS PRODUCING WELL, A NATURAL GAS PRODUCING WELL, AND A COAL BED METHANE WELL

Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE	June 2, 1994
HRI PROJECT	009-93
HRI SERIES NO.	E206/94-A
DATE RECD.	05/10/94
CUST P.O.#	10562

Evergreen Analytical, Inc.
Carl Smits
4036 Youngfield
Wheat Ridge, CO 80033

REPORT OF ANALYSIS

SAMPLE NO. E206/94-1
SAMPLE IDENTIFICATION: FTE-A 94-1628 05/09/94 @ 1232

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	16(±67)	32	EPA 900.0	05/25/94	EdF
Radium 226(±Precision*),pCi/l (T)	0.9(±1.4)	0.7	SM 705	05/20/94	RO
Radium 228(±Precision*),pCi/l (T)	0.2(±1.7)	2.0	Modified Ra-05	05/13/94	LD
Uranium, mg/l (T)	<0.002	0.002	ASTM D2907	05/13/94	ES
Uranium, pCi/l (T)**	<1	1	ASTM D2907	05/13/94	ES

By: _____
Robert Rostad
Laboratory Manager

CODES:
(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.
**Uranium results reported assuming the activity of natural U = 6.77×10^{-7} Ci/g.

Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE	June 2, 1994
HRI PROJECT	009-93
HRI SERIES NO.	E206/94-B
DATE RECD.	05/10/94
CUST P.O.#	10562

Evergreen Analytical, Inc.
Carl Smits
4036 Youngfield
Wheat Ridge, CO 80033

REPORT OF ANALYSIS

SAMPLE NO. E206/94-2
SAMPLE IDENTIFICATION: FTE-B 94-1628 05/09/94 @ 1256

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	0(±20)	5	EPA 900.0	05/25/94	EdF
Radium 226(±Precision*),pCi/l (T)	3.6(±1.5)	0.4	SM 705 Modified	05/20/94	RO
Radium 228(±Precision*),pCi/l (T)	1.2(±1.9)	2.0	Ra-05	05/17/94	LD
Uranium, mg/l (T)	<0.002	0.002	ASTM D2907	05/13/94	ES
Uranium, pCi/l (T)**	<1	1	ASTM D2907	05/13/94	ES

By: _____
Robert Rostad
Laboratory Manager

CODES:
(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.
**Uranium results reported assuming the activity of natural U = 6.77×10^{-7} Ci/g.

Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE	June 2, 1994
HRI PROJECT	009-93
HRI SERIES NO.	E206/94-C
DATE RECD.	05/10/94
CUST P.O.#	10562

Evergreen Analytical, Inc.
Carl Smits
4036 Youngfield
Wheat Ridge, CO 80033

REPORT OF ANALYSIS

SAMPLE NO. E206/94-3
SAMPLE IDENTIFICATION: FTE-C 94-1628 05/09/94 @ 1320

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	68(±84)	23	EPA 900.0	05/25/94	EdF
Radium 226(±Precision*),pCi/l (T)	1.2(±0.7)	0.3	SM 705 Modified	05/20/94	RO
Radium 228(±Precision*),pCi/l (T)	3.9(±2.1)	2.0	Ra-05	05/13/94	LD
Uranium, mg/l (T)	<0.002	0.002	ASTM D2907	05/13/94	ES
Uranium, pCi/l (T)**	<1	1	ASTM D2907	05/13/94	ES

By: _____
Robert Rostad
Laboratory Manager

CODES:
(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.
**Uranium results reported assuming the activity of natural U = 6.77×10^{-7} Ci/g.

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

INORGANIC ANALYSIS DATA SHEET

Date Sampled :05/09/94
Date Received:05/10/94
Date Prepared:05/12/94
Date Analyzed:05/25/94

Client Project :FTE
Lab Project No.:94-1628
Method :600/4-79-020
Matrix :Water

Units: mg/L

Basis: Total Metal

Client Sample#	FTE-A	FTE-B	FTE-C		
Evergreen Sample#	X87269D	X87270D	X87271D	Reagent Blank	Reporting Limits
Sr	4.6	7.6	11	< 0.001	0.001

Analyst

Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

VOLATILE ORGANICS ANALYSIS DATA
Target Compound List

Client Sample Number	: FTE-A		
Lab Sample Number	: X87269	Client I.D.	: FTE
Date Sampled	: 05/09/94	Lab Project No.	: 94-1628
Date Received	: 05/10/94	Effective Dilution	: 100.00
Date Extracted/Prepared	: 05/18/94	Method	: 624
Date Analyzed	: 05/18/94	Matrix	: WATER
		Lab File No.	: >L8260
		Method Blank No.	: RB051894

Compound Name	Cas Number	Conc ug/L		Reporting Limit* ug/L
Chloromethane	74-87-3		U	100.0
Bromomethane	74-83-9		U	100.0
Vinyl Chloride	75-01-4		U	100.0
Chloroethane	75-00-3		U	100.0
Methylene Chloride	75-09-2		U	100.0
Acetone	67-64-1	15,000	B	1000.0
Carbon Disulfide	75-15-0	190		100.0
1,1-Dichloroethene	75-35-4		U	100.0
1,1-Dichloroethane	75-34-3		U	100.0
Trans-1,2-Dichloroethene	156-60-5		U	100.0
Cis-1,2-Dichloroethene	156-59-2		U	100.0
Chloroform	67-66-3	120	B	100.0
1,2-Dichloroethane	107-06-2		U	100.0
2-Butanone	78-93-3	1,400		1000.0
1,1,1-Trichloroethane	71-55-6		U	50.0
Carbon Tetrachloride	56-23-5		U	200.0
Bromodichloromethane	75-27-4		U	100.0
Vinyl Acetate	108-05-4		U	1000.0
1,2-Dichloropropane	78-87-5		U	100.0
Trans-1,3-Dichloropropene	10061-02-6		U	200.0
Trichloroethene	79-01-6		U	100.0
1,1,2-Trichloroethane	79-00-5		U	100.0
Benzene	71-43-2	15,000		50.0
Dibromochloromethane	124-48-1		U	100.0
Cis-1,3-Dichloropropene	10061-01-5		U	100.0
2-Chloroethylvinyl Ether	110-75-8		U	500.0
Bromoform	75-25-2		U	100.0
4-Methyl-2-Pentanone	108-10-1		U	500.0
2-Hexanone	591-78-6		U	500.0
1,1,2,2-Tetrachloroethane	79-34-5		U	100.0
Tetrachloroethene	127-18-4		U	100.0
Toluene	108-88-3	9,100		50.0
Chlorobenzene	108-90-7		U	100.0
Ethyl Benzene	100-41-4	180		50.0
Styrene	100-42-5		U	100.0
Total Xylenes	1330-20-7	1,700		50.0
Trichlorofluoromethane	75-69-4		U	50.0

Surrogate Recoveries:		QC Limits
1,2 Dichloroethane-d4	95%	(94-112)
Toluene-d8	99%	(94-104)
Bromofluorobenzene	95%	(92-105)

QUALIFIERS:
U = Compound analyzed for, but not detected above the reporting limit.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
NA = Not applicable or not available.

Analyst

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

VOLATILE ORGANICS ANALYSIS DATA
Target Compound List

Client Sample Number	: FTE-B		
Lab Sample Number	: X87270	Client I.D.	: FTE
Date Sampled	: 05/09/94	Lab Project No.	: 94-1628
Date Received	: 05/10/94	Effective Dilution	: 10.00
Date Extracted/Prepared	: 05/18/94	Method	: 624
Date Analyzed	: 05/18/94	Matrix	: WATER
		Lab File No.	: >L8261
		Method Blank No.	: RB051894

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
Chloromethane	74-87-3		U	10.0
Bromomethane	74-83-9		U	10.0
Vinyl Chloride	75-01-4		U	10.0
Chloroethane	75-00-3		U	10.0
Methylene Chloride	75-09-2		U	10.0
Acetone	67-64-1	140	B	100.0
Carbon Disulfide	75-15-0		U	10.0
1,1-Dichloroethene	75-35-4		U	10.0
1,1-Dichloroethane	75-34-3		U	10.0
Trans-1,2-Dichloroethene	156-60-5		U	10.0
Cis-1,2-Dichloroethene	156-59-2		U	10.0
Chloroform	67-66-3	12	B	10.0
1,2-Dichloroethane	107-06-2		U	10.0
2-Butanone	78-93-3		U	100.0
1,1,1-Trichloroethane	71-55-6		U	5.0
Carbon Tetrachloride	56-23-5		U	20.0
Bromodichloromethane	75-27-4		U	10.0
Vinyl Acetate	108-05-4		U	100.0
1,2-Dichloropropane	78-87-5		U	10.0
Trans-1,3-Dichloropropene	10061-02-6		U	20.0
Trichloroethene	79-01-6		U	10.0
1,1,2-Trichloroethane	79-00-5		U	10.0
Benzene	71-43-2	1,800		5.0
Dibromochloromethane	124-48-1		U	10.0
Cis-1,3-Dichloropropene	10061-01-5		U	10.0
2-Chloroethylvinyl Ether	110-75-8		U	50.0
Bromoform	75-25-2		U	10.0
4-Methyl-2-Pentanone	108-10-1		U	50.0
2-Hexanone	591-78-6		U	50.0
1,1,2,2-Tetrachloroethane	79-34-5		U	10.0
Tetrachloroethene	127-18-4		U	10.0
Toluene	108-88-3	870		5.0
Chlorobenzene	108-90-7		U	10.0
Ethyl Benzene	100-41-4		U	5.0
Styrene	100-42-5		U	10.0
Total Xylenes	1330-20-7	470		5.0
Trichlorofluoromethane	75-69-4		U	5.0

Surrogate Recoveries:		QC Limits
1,2 Dichloroethane-d4	92% X	(94-112)
Toluene-d8	99%	(94-104)
Bromofluorobenzene	95%	(92-105)

QUALIFIERS:
X = **Poor surrogate recovery exhibited in duplicate indicating matrix effect.**
U = Compound analyzed for, but not detected above the reporting limit.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
NA = Not applicable or not available.

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

VOLATILE ORGANICS ANALYSIS DATA
Target Compound List

Client Sample Number	: FTE-C	Client I.D.	: FTF
Lab Sample Number	: X87271	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 1.00
Date Received	: 05/10/94	Method	: 624
Date Extracted/Prepared	: 05/16/94	Matrix	: WATER
Date Analyzed	: 05/16/94	Lab File No.	: >L8214
		Method Blank No.	: RB051694

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
Chloromethane	74-87-3	U		1.0
Bromomethane	74-83-9	U		1.0
Vinyl Chloride	75-01-4	U		1.0
Chloroethane	75-00-3	U		1.0
Methylene Chloride	75-09-2	U		1.0
Acetone	67-64-1	U		10.0
Carbon Disulfide	75-15-0	U		1.0
1,1-Dichloroethene	75-35-4	U		1.0
1,1-Dichloroethane	75-34-3	U		1.0
Trans-1,2-Dichloroethene	156-60-5	U		1.0
Cis-1,2-Dichloroethene	156-59-2	U		1.0
Chloroform	67-66-3	U		1.0
1,2-Dichloroethane	107-06-2	U		1.0
2-Butanone	78-93-3	U		10.0
1,1,1-Trichloroethane	71-55-6	U		0.5
Carbon Tetrachloride	56-23-5	U		2.0
Bromodichloromethane	75-27-4	U		1.0
Vinyl Acetate	108-05-4	U		10.0
1,2-Dichloropropane	78-87-5	U		1.0
Trans-1,3-Dichloropropene	10061-02-6	U		2.0
Trichloroethene	79-01-6	U		1.0
1,1,2-Trichloroethane	79-00-5	U		1.0
Benzene	71-43-2	U		0.5
Dibromochloromethane	124-48-1	U		1.0
Cis-1,3-Dichloropropene	10061-01-5	U		1.0
2-Chloroethylvinyl Ether	110-75-8	U		5.0
Bromoform	75-25-2	U		1.0
4-Methyl-2-Pentanone	108-10-1	U		5.0
2-Hexanone	591-78-6	U		5.0
1,1,2,2-Tetrachloroethane	79-34-5	U		1.0
Tetrachloroethene	127-18-4	U		1.0
Toluene	108-88-3	1		0.5
Chlorobenzene	108-90-7		U	1.0
Ethyl Benzene	100-41-4	U		0.5
Styrene	100-42-5	U		1.0
Total Xylenes	1330-20-7	U		0.5
Trichlorofluoromethane	75-69-4	U		0.5

Surrogate Recoveries:		QC Limits
1,2 Dichloroethane-d4	109%	(94-112)
Toluene-d8	104%	(94-104)
Bromofluorobenzene	100%	(92-105)

QUALIFIERS:
U = Compound analyzed for, but not detected above the reporting limit.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
NA = Not applicable or not available.

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

Semivolatile Analysis Data Report
Page 1

Client Sample Number	: FTE-A	Client I.D.	: FTE
Lab Sample Number	: X87269	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 50.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/17/94	Lab File No.	: >25532
		Method Blank No.	: WB051194

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
bis(2-Chloroethyl)Ether	111-44-4		U	50.0
1,3-Dichlorobenzene	541-73-1		U	25.0
1,4-Dichlorobenzene	106-46-7		U	25.0
1,2-Dichlorobenzene	95-50-1		U	25.0
bis(2-chloroisopropyl)Ether	108-60-1		U	50.0
N-Nitroso-Di-n-Propylamine	621-64-7		U	50.0
Hexachloroethane	67-72-1		U	25.0
Nitrobenzene	98-95-3		U	50.0
Isophorone	78-59-1		U	50.0
bis(2-Chloroethoxy)Methane	111-91-1		U	50.0
1,2,4-Trichlorobenzene	120-82-1		U	25.0
Naphthalene	91-20-3	39		25.0
4-Chloroaniline	106-47-8		U	100.0
Hexachlorobutadiene	87-68-3		U	25.0
2-Methylnaphthalene	91-57-6	29		25.0
Hexachlorocyclopentadiene	77-47-4		U	100.0
2-Chloronaphthalene	91-58-7		U	25.0
2-Nitroaniline	88-74-4		U	100.0
Dimethylphthalate	131-11-3		U	25.0
2,6-Dinitrotoluene	606-20-2		U	100.0
Acenaphthylene	208-96-8		U	25.0
3-Nitroaniline	99-09-2		U	100.0
Acenaphthene	83-32-9		U	25.0
Dibenzofuran	132-64-9		U	25.0
2,4-Dinitrotoluene	121-14-2		U	100.0
Diethylphthalate	84-66-2		U	25.0
4-Chlorophenyl-phenylether	7005-72-3		U	25.0
Fluorene	86-73-7	49		25.0
4-Nitroaniline	100-01-6		U	100.0
N-Nitrosodiphenylamine	86-30-6		U	25.0
4-Bromophenyl-phenylether	101-55-3		U	25.0
Hexachlorobenzene	118-74-1		U	25.0
Phenanthrene	85-01-8		U	25.0
Anthracene	120-12-7		U	25.0
Di-n-Butylphthalate	84-74-2		U	25.0
Fluoranthene	206-44-0		U	25.0
Pyrene	129-00-0		U	25.0
Butylbenzylphthalate	85-68-7		U	25.0
3,3'-Dichlorobenzidine	91-94-1		U	100.0
Benzo(a)Anthracene	56-55-3		U	25.0
bis(2-Ethylhexyl)Phthalate	117-81-7		U	25.0
Chrysene	218-01-9		U	25.0
Di-n-Octyl Phthalate	117-84-0		U	25.0
Benzo(b)Fluoranthene	205-99-2		U	25.0
Benzo(k)Fluoranthene	207-08-9		U	25.0
Benzo(a)Pyrene	50-32-8		U	25.0
Indeno(1,2,3-cd)Pyrene	193-39-5		U	25.0
Dibenz(a,h)Anthracene	53-70-3		U	25.0
Benzo(g,h,i)Perylene	191-24-2		U	25.0

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

Semivolatile Analysis Data Report

Client Sample Number	: FTE-A	Client I.D.	: FTE
Lab Sample Number	: X87269	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 50.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/17/94	Lab File No.	: >25532
		Method Blank No.	: WB051194

ACIDS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
Phenol	108-95-2	3,100		100.0
2-Chlorophenol	95-57-8		U	100.0
Benzylalcohol	100-51-6		U	250.0
2-Methylphenol	95-48-7	930		50.0
4-Methylphenol	106-44-5	650		50.0
2-Nitrophenol	88-75-5		U	100.0
2,4-Dimethylphenol	105-67-9	200		100.0
Benzoic Acid	65-85-0		U	250.0
2,4-Dichlorophenol	120-83-2		U	100.0
4-Chloro-3-Methylphenol	59-50-7		U	100.0
2,4,6-Trichlorophenol	88-06-2		U	100.0
2,4-Dinitrophenol	51-28-5		U	500.0
4-Nitrophenol	100-02-7		U	250.0
4,6-Dinitro-2-Methylphenol	534-52-1		U	500.0
Pentachlorophenol	87-86-5		U	250.0
2,4,5-Trichlorophenol	95-95-4		U	100.0

Expected Surrogate Recoveries:		Actual Recoveries:			QC Limits
Nitrobenzene-d5	100	ug/L	41%		(35-113)
2-Fluorobiphenyl	100	ug/L	70%		(45-116)
Terphenyl-d14	100	ug/L	68%		(33- 95)
Phenol-d6	200	ug/L	88%		(40- 94)
2-Fluorophenol	200	ug/L	69%		(35-100)
2,4,6 Tribromophenol	200	ug/L	17%	X	(30-123)

QUALIFIERS:
X = Surrogates nearly diluted out.
U = Compound analyzed for, but not detected above the reporting limits.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
Unless otherwise noted concentrations for soils are reported on a dry weight basis. (NA = not applicable or not available)

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Semivolatile Analysis Data Report
Page 1

Client Sample Number	: FTE-B	Client I.D.	: FTE
Lab Sample Number	: X87270	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 10.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/17/94	Lab File No.	: >25531
		Method Blank No.	: WB051194

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
bis(2-Chloroethyl)Ether	111-44-4		U	10.0
1,3-Dichlorobenzene	541-73-1		U	5.0
1,4-Dichlorobenzene	106-46-7		U	5.0
1,2-Dichlorobenzene	95-50-1		U	5.0
bis(2-chloroisopropyl)Ether	108-60-1		U	10.0
N-Nitroso-Di-n-Propylamine	621-64-7		U	10.0
Hexachloroethane	67-72-1		U	5.0
Nitrobenzene	98-95-3		U	10.0
Isophorone	78-59-1		U	10.0
bis(2-Chloroethoxy)Methane	111-91-1		U	10.0
1,2,4-Trichlorobenzene	120-82-1		U	5.0
Naphthalene	91-20-3	6		5.0
4-Chloroaniline	106-47-8		U	20.0
Hexachlorobutadiene	87-68-3		U	5.0
2-Methylnaphthalene	91-57-6	33		5.0
Hexachlorocyclopentadiene	77-47-4		U	20.0
2-Chloronaphthalene	91-58-7		U	5.0
2-Nitroaniline	88-74-4		U	20.0
Dimethylphthalate	131-11-3		U	5.0
2,6-Dinitrotoluene	606-20-2		U	20.0
Acenaphthylene	208-96-8		U	5.0
3-Nitroaniline	99-09-2		U	20.0
Acenaphthene	83-32-9		U	5.0
Dibenzofuran	132-64-9		U	5.0
2,4-Dinitrotoluene	121-14-2		U	20.0
Diethylphthalate	84-66-2		U	5.0
4-Chlorophenyl-phenylether	7005-72-3		U	5.0
Fluorene	86-73-7		U	5.0
4-Nitroaniline	100-01-6		U	20.0
N-Nitrosodiphenylamine	86-30-6		U	5.0
4-Bromophenyl-phenylether	101-55-3		U	5.0
Hexachlorobenzene	118-74-1		U	5.0
Phenanthrene	85-01-8	6		5.0
Anthracene	120-12-7		U	5.0
Di-n-Butylphthalate	84-74-2		U	5.0
Fluoranthene	206-44-0		U	5.0
Pyrene	129-00-0		U	5.0
Butylbenzylphthalate	85-68-7		U	5.0
3,3'-Dichlorobenzidine	91-94-1		U	20.0
Benzo(a)Anthracene	56-55-3		U	5.0
bis(2-Ethylhexyl)Phthalate	117-81-7	200		5.0
Chrysene	218-01-9		U	5.0
Di-n-Octyl Phthalate	117-84-0	23		5.0
Benzo(b)Fluoranthene	205-99-2		U	5.0
Benzo(k)Fluoranthene	207-08-9		U	5.0
Benzo(a)Pyrene	50-32-8		U	5.0
Indeno(1,2,3-cd)Pyrene	193-39-5		U	5.0
Dibenz(a,h)Anthracene	53-70-3		U	5.0
Benzo(g,h,i)Perylene	191-24-2		U	5.0

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

Semivolatile Analysis Data Report
Page 2

Client Sample Number	: FTE-B	Client I.D.	: FTE
Lab Sample Number	: X87270	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 10.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/17/94	Lab File No.	: >25531
		Method Blank No.	: WB051194

ACIDS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
Phenol	108-95-2	110		20.0
2-Chlorophenol	95-57-8		U	20.0
Benzylalcohol	100-51-6		U	50.0
2-Methylphenol	95-48-7	220		10.0
4-Methylphenol	106-44-5	10		10.0
2-Nitrophenol	88-75-5		U	20.0
2,4-Dimethylphenol	105-67-9	150		20.0
Benzoic Acid	65-85-0		U	50.0
2,4-Dichlorophenol	120-83-2		U	20.0
4-Chloro-3-Methylphenol	59-50-7		U	20.0
2,4,6-Trichlorophenol	88-06-2		U	20.0
2,4-Dinitrophenol	51-28-5		U	100.0
4-Nitrophenol	100-02-7		U	50.0
4,6-Dinitro-2-Methylphenol	534-52-1		U	100.0
Pentachlorophenol	87-86-5		U	50.0
2,4,5-Trichlorophenol	95-95-4		U	20.0

Expected Surrogate Recoveries:		Actual Recoveries:			QC Limits
Nitrobenzene-d5	100	ug/L	69%		(35-113)
2-Fluorobiphenyl	100	ug/L	38%	X	(45-116)
Terphenyl-d14	100	ug/L	38%		(33- 95)
Phenol-d6	200	ug/L	63%		(40- 94)
2-Fluorophenol	200	ug/L	62%		(35-100)
2,4,6 Tribromophenol	200	ug/L	47%		(30-123)

QUALIFIERS:
X = **Surrogate nearly diluted out.**
U = Compound analyzed for, but not detected above the reporting limits.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
Unless otherwise noted concentrations for soils are reported on a dry weight basis. (NA = not applicable or not available)

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(303)425-6021

Semivolatile Analysis Data Report
Page 1

Client Sample Number	: FTE-C	Client I.D.	: FTE
Lab Sample Number	: X87271	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 1.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/13/94	Lab File No.	: >25497
		Method Blank No.	: WB051194

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
bis(2-Chloroethyl)Ether	111-44-4		U	1.0
1,3-Dichlorobenzene	541-73-1		U	0.5
1,4-Dichlorobenzene	106-46-7		U	0.5
1,2-Dichlorobenzene	95-50-1		U	0.5
bis(2-chloroisopropyl)Ether	108-60-1		U	1.0
N-Nitroso-Di-n-Propylamine	621-64-7		U	1.0
Hexachloroethane	67-72-1		U	0.5
Nitrobenzene	98-95-3		U	1.0
Isophorone	78-59-1		U	1.0
bis(2-Chloroethoxy)Methane	111-91-1		U	1.0
1,2,4-Trichlorobenzene	120-82-1		U	0.5
Naphthalene	91-20-3		U	0.5
4-Chloroaniline	106-47-8		U	2.0
Hexachlorobutadiene	87-68-3		U	0.5
2-Methylnaphthalene	91-57-6		U	0.5
Hexachlorocyclopentadiene	77-47-4		U	2.0
2-Chloronaphthalene	91-58-7		U	0.5
2-Nitroaniline	88-74-4		U	2.0
Dimethylphthalate	131-11-3		U	0.5
2,6-Dinitrotoluene	606-20-2		U	2.0
Acenaphthylene	208-96-8		U	0.5
3-Nitroaniline	99-09-2		U	2.0
Acenaphthene	83-32-9		U	0.5
Dibenzofuran	132-64-9		U	0.5
2,4-Dinitrotoluene	121-14-2		U	2.0
Diethylphthalate	84-66-2		U	0.5
4-Chlorophenyl-phenylether	7005-72-3		U	0.5
Fluorene	86-73-7		U	0.5
4-Nitroaniline	100-01-6		U	2.0
N-Nitrosodiphenylamine	86-30-6		U	0.5
4-Bromophenyl-phenylether	101-55-3		U	0.5
Hexachlorobenzene	118-74-1		U	0.5
Phenanthrene	85-01-8		U	0.5
Anthracene	120-12-7		U	0.5
Di-n-Butylphthalate	84-74-2		U	0.5
Fluoranthene	206-44-0		U	0.5
Pyrene	129-00-0		U	0.5
Butylbenzylphthalate	85-68-7		U	0.5
3,3'-Dichlorobenzidine	91-94-1		U	2.0
Benzo(a)Anthracene	56-55-3		U	0.5
bis(2-Ethylhexyl)Phthalate	117-81-7	15		0.5
Chrysene	218-01-9		U	0.5
Di-n-Octyl Phthalate	117-84-0		U	0.5
Benzo(b)Fluoranthene	205-99-2		U	0.5
Benzo(k)Fluoranthene	207-08-9		U	0.5
Benzo(a)Pyrene	50-32-8		U	0.5
Indeno(1,2,3-cd)Pyrene	193-39-5		U	0.5
Dibenz(a,h)Anthracene	53-70-3		U	0.5
Benzo(g,h,i)Perylene	191-24-2		U	0.5

Analyst

Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield Wheat Ridge CO 80033
(303)425-6021

Semivolatile Analysis Data Report
Page 2

Client Sample Number	: FTE-C	Client I.D.	: FTE
Lab Sample Number	: X87271	Lab Project No.	: 94-1628
Date Sampled	: 05/09/94	Effective Dilution	: 1.00
Date Received	: 05/10/94	Method	: 625
Date Extracted/Prepared	: 05/11/94	Matrix	: WATER
Date Analyzed	: 05/13/94	Lab File No.	: >25497
		Method Blank No.	: WB051194

ACIDS

Compound Name	Cas Number	Conc. ug/L		Reporting Limit* ug/L
Phenol	108-95-2		U	2.0
2-Chlorophenol	95-57-8		U	2.0
Benzylalcohol	100-51-6		U	5.0
2-Methylphenol	95-48-7		U	1.0
4-Methylphenol	106-44-5		U	1.0
2-Nitrophenol	88-75-5		U	2.0
2,4-Dimethylphenol	105-67-9		U	2.0
Benzoic Acid	65-85-0		U	5.0
2,4-Dichlorophenol	120-83-2		U	2.0
4-Chloro-3-Methylphenol	59-50-7		U	2.0
2,4,6-Trichlorophenol	88-06-2		U	2.0
2,4-Dinitrophenol	51-28-5		U	10.0
4-Nitrophenol	100-02-7		U	5.0
4,6-Dinitro-2-Methylphenol	534-52-1		U	10.0
Pentachlorophenol	87-86-5		U	5.0
2,4,5-Trichlorophenol	95-95-4		U	2.0

Expected Surrogate Recoveries:		Actual Recoveries:		QC Limits
Nitrobenzene-d5	100 ug/L	73%		(35-113)
2-Fluorobiphenyl	100 ug/L	70%		(45-116)
Terphenyl-d14	100 ug/L	73%		(33- 95)
Phenol-d6	200 ug/L	66%		(40- 94)
2-Fluorophenol	200 ug/L	62%		(35-100)
2,4,6 Tribromophenol	200 ug/L	65%		(30-123)

QUALIFIERS:
U = Compound analyzed for, but not detected above the reporting limits.
B = Compound found in blank and sample. Compare blank and sample data.
* = Reporting limits are roughly the method detection limits for reagent water
E = Compound is detected but concentration is outside of calibration limits.
Unless otherwise noted concentrations for soils are reported on a dry weight basis. (NA = not applicable or not available)

Analyst

Approved

DATE
FILMED
10/5/94
END